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INTERNATIONAL TSUNAMI INFORMATION CENTER

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Director: Dr. George Pararas-Carayannis

TSUNAMI NEWSLETTER is published by the International Tsunami Information Center to bring news and information to scientists, engineers, educators, community protection agencies and governments throughout the world.

We welcome contributions from our readers.

The International Tsunami Information Center is maintained by the U.S. National Oceanic and Atmospheric Administration for the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization. The Center's mission is to mitigate the effects of tsunamis throughout the Pacific.

MEMBER STATES

Present membership of the International Coordination Group for the Tsunami Warning System in the Pacific comprises of the following States:

CANADA
CHILE
COLOMBIA
COOK ISLANDS
ECUADOR
FIJI
FRANCE
GUATEMALA
INDONESIA
JAPAN
KOREA (REPUBLIC OF)
MEXICO
NEW ZEALAND
PERU
PHILIPPINES
SINGAPORE
THAILAND
UNITED KINGDOM (HONG KONG)
USA
USSR
WESTERN SAMOA

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FEATURE

Tsunamis in the Andaman Sea

T.S. Murty
Institute of Ocean Sciences
Dept. of Fisheries and Oceans
Sidney, Canada

The Andaman Sea is located at the southeastern end of the Alpine-Himalayan belt and is a seismically active area. Sinvhal et al (1978) and Verma et al (1978) discussed the seismicity of this area. Bapat (1982) mentions that during the period 1900 to 1980, in the area bounded by 7.0 N to 22.0 N and 88.0 E to 100 E, a total of 348 earthquakes were recorded. In his Table 1, he provided information on the number of earthquakes in the magnitude range of 3.3 to 4.0, 4.1 to 4.5, 4.6 to 5.0, 5.1 to 5.5, 5.6 to 6.0, 6.1 to 6.5, 6.6 to 7.0, 7.1 to 7.5, 7.6 to 8.0 and 8.1 to 8.5. He asks the question, why there are few tsunamis although several earthquakes occurred here.

This question can be answered as follows. First of all, the fact that there are a large number of earthquakes in the Andaman Sea area, the data has to be interpreted correctly from the point of tsunami generation. As is generally known, significant tsunamis will not be generated (unless the earthquake occurs in a shallow and confined small body of water) for earthquakes with magnitudes less than about 7.2 (Murty, 1977). In Table 1 of Bapat, there are only five earthquakes with magnitudes equal to or greater than 7.1. In Table 2 of Bapat, six tsunamis are listed. If we ignore the tsunami due to the Krakatoa eruption of August 1883, then five tsunamis occurred due to local earthquakes (i.e., earthquakes in the Bay of Bengal).

In Table 1 of Verma et al (1978), for the period of 1916 to 1975, only three earthquakes are listed which have magnitudes greater than 7.2. Thus the number of earthquakes in the Andaman Sea which have magnitudes great enough to generate significant tsunamis is only three during the period 1916 to 1975. Out of these three earthquakes in the Table 1 of Verma et al, only one earthquake has a magnitude greater than 8.0. This earthquake of June 26th, 1941, did generate a major tsunami that killed more than 5,000 people on the east coast of India. However, at that time, the media erroneously attributed the deaths and damage to a storm surge. Meteorological records do not show (Murty, 1984) any storm surge on that date on the east coast of India.

The two other earthquakes with magnitudes of 7.25 to 7.3 (which respectively occurred on 17 May 1955, and 23 August 1936) probably did not generate significant tsunamis for the following reason. Tsunamis usually are associated with dip-slip type earthquakes (in which the ocean bottom predominantly moves in a vertical direction) rather than with strike-slip type earthquakes (in which the movement is mainly in

the horizontal direction). Pickering (1981) states that the earthquakes in the Andaman area are associated mainly with strike-slip type of faulting. Hence, it is unlikely that earthquakes with magnitudes less than about 8.0 could cause significant tsunamis in the Andaman Sea region.

In summary, large earthquakes in the Andaman Sea area generate tsunamis, such as the one that occurred on 26 June 1941. Walker (1884) described a tsunami on 31 December 1881, due to an earthquake in the western part of the Bay of Bengal.

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Sinvhal, H., Khattri, K.N., Rai, K. and V.K. Gaur. (1978) Neotectonics and time-space seismicity of the Andaman Nicobar region, Bulletin of the Seismological Society of America, Volume 68, No. 2, 399-409.

Verma, R.K., Mukhopadhyay, M. and N.C. Bhuin. (1978) Seismicity, gravity and tectonics in the Andaman Sea, In "Geodynamics of the Western Pacific", proceedings of the International Conference on Geodynamics of the Western Pacific - Indonesian Region, March 1978, Tokyo, Advances in Earth and Planetary Science 6, Supplement Issue of Journal of Physics of the Earth, edited by S. Uyeda, R.W. Murphy and K. Kobayashi, Center for Academic Publications, Japan Scientific Societies Press, Tokyo, 233-248.

Walker, J.T. (1884) Earthquake disturbances of the tides on the coasts of India, Nature, 14 February 1884 Issue, 358-360.

NEWS EVENTS

Chilean Earthquake and Tsunami of 3 March 1985

On 3 March 1985, at 2247Z a major earthquake measuring at 7.4 on the Richter scale occurred off the coast of Chile near Valparaiso. The epicenter of the quake was at 34.2S and 70.4W.

The earthquake caused considerable damages in Valparaiso and in Santiago. At least 124 people were killed and 2,000 injured. A tsunami was generated which propagated across the Pacific Basin and was recorded at many tide stations of the Tsunami Warning System of the Pacific (TWS). There was an initial rise of 50 cm at 2305Z followed by a decrease of 40 cm at Valparaiso. A maximum sea level fluctuation of 110 cm was recorded in the same area at 0005Z, 4 March, 1985. No sea level fluctuations were recorded at Coquimbo, Talcahuano, and Puerto Montt, which are located within 200 miles north and south of the tsunami source area.

The following are reports of tsunami run-up received from various tsunami stations:

Ecuador	15 cm at 0045Z with period of 54 minutes.
Rikitea, French Polynesia	11 cm.
Papeete, Tahiti	10 cm.
Honuapo, Hawaii	7-11 cm at 1333Z with period of 15 minutes.
Kailua-Kona, Hawaii	5-7 cm at 1348Z with period of 10 minutes.
Hilo, Hawaii	48 cm at 1355Z with period of 17 minutes.
Mahukona, Hawaii	5 cm at 1504Z with period of 17 minutes.
Kahului, Hawaii	36 cm.
Honolulu, Hawaii	3 cm at 1416Z with period of 17 minutes.
Pu'uloa, Hawaii	3 cm at 1433Z with period of 24 minutes.
Kushiro, Japan	10 cm.
Nemuro, Japan	10 cm.
Adak, Alaska	12 cm at 1938Z with period of 8 minutes.
Sand Point, Alaska	15 cm at 1830Z with period of 24 minutes.
Kodiak, Alaska	4 cm at 1825Z with period of 15 minutes.
Seward, Alaska	5 cm at 1727Z with period of 7 minutes.
Yakutat, Alaska	Tiny ripples.

No tsunami was recorded at Rarotonga, Cook Islands; Majuro, Marshall Islands; Johnston Island; and Sitka, Alaska. No reports of damage were received from any stations, including Valparaiso as a result of the tsunami.

Chilean Earthquake of 9 April 1985

Another major earthquake occurred at 33.6S and 71.4W near Valparaiso, Chile on 9 April 1985 at 0157Z. The quake had a magnitude of 7.2 on the Richter Scale. Though the earthquake was of a high magnitude, it did not generate any tsunami.

Other Earthquakes in the Pacific

Sulawesi, Indonesia--On 2 March 1985 an earthquake of 6.6 magnitude rocked through west central Sulawesi. No damage or casualties were reported, but electric service was interrupted.

Mindanao, Philippines--An earthquake measuring 6.5 on the Richter scale hit Mindanao Island on 18 March 1985, injuring 20 people. One person died of a heart attack. At least 25 houses were demolished and many buildings damaged. The earthquake was centered a few kilometers offshore of Pagadian, and was felt throughout Mindanao and on South Leyte.

Molucca Sea, Indonesia--Two earthquakes rumbled through Indonesia on 13 April 1985. The first earthquake damaged several buildings in Denpasar, on the southeast coast of Bali. Unconfirmed reports said that the shock generated waves several meters high on Bali's southern beaches. Two hours later, the second earthquake shook Manado, the capital of North Sulawesi, but no damage or casualties were reported.

INTERNATIONAL TSUNAMI INFORMATION CENTER

Director, ITIC attended the 13th Session of IOC Assembly in Paris, France

Dr. George Pararas-Carayannis, Director of ITIC attended the 13th Session of the IOC General Assembly in Paris in March. The ITIC staff prepared a number of displays on tsunamis ICG activities, which were taken to Paris and exhibited at the conference site. These displays were left with IOC as a permanent exhibit and as a constant reminder of the tsunami program to IOC visitors and staff and for the purpose of illustrating IOC's involvement and support. Dr. Pararas-Carayannis had the opportunity to address the general assembly on the Tsunami Program and to illustrate cooperation with other programs sponsored by IOC. In addition, he met individually with many of the delegates from

ICG/ITSU member states to discuss matters pertaining to operational problems of the Tsunami Warning System. While at UNESCO, Dr. Pararas-Carayannis had an interview with the public relations office of UNESCO regarding the Tsunami program and made arrangements with Mr. Lawrence Bond of Trans-Atlantic Video for the production of a UNESCO sponsored film on the operations of the Tsunami Warning System.

While at the IOC Secretariat, Dr. Pararas-Carayannis, assisted with the preparation of a contract with IOC to support day to day operations of ITIC and participation to the Tsunami Workshop in Sidney, B.C. this summer.

Director presented a paper at the 15th Conference on Broadcast Meteorology of the American Meteorological Society

"Tsunami: Forecasting, Preparedness and Warning" was the topic of Dr. George Pararas-Carayannis's paper presented at the above mentioned conference held in Honolulu, Hawaii 9-12 April 1985.

Visitors to ITIC

Christopher Farran	Honolulu, HI
Alan Williamson	Partnership Productions, Auckland, NZ
Robert Hee	Corporation of Engineers, Honolulu, HI
Dayle Yonashiro	Blood Bank of Hawaii
Diane Henderson	Environmentalist, Honolulu, HI
Shunichi Yamazaki	NHK-TV, Tokyo, Japan
Ernesto Cajiao	Commander-Secretary, Bogota, Colombia
Yoshie Okutomi	Tokyo, Japan
Annette Fukuda	Foreign Language Lab, Univ. of Hawaii
Alvin Nishikawa	Wiss Janney Elstner Assoc, Inc. Hon, HI.
Van Dorn	Scrippt Institute
Mickey K. Moss	Pacific Tide Party, Seattle, WA
Bob Henderson	WASC
Fred Casciano	Cook Laboratory
Bruce W. Turner	PTWC, Honolulu, HI
Takaharu Nakano	Weathercaster, Tokyo, Japan
JoAnn Romano	American Hawaii Cruises
Edward Flaherty	Cross-Communications Europe, Paris, France
Elisa Yadao	KGMB News, Honolulu, HI
Grant Couching	KGMB News, Honolulu, HI
Larry Bond	Cross-Communications Europe, Paris, France
Peter L. Milewski	United Coast Guard, Honolulu, HI
Sigmund R. Petersen	Commanding Officer, NOAA Discoverer
Frederick J. Hoeblin	PAB, NOAA ERL
Paul Takamiya	Oahu Civil Defense Agency
Robert Chase	Unit Training, Barbers Point, HI
Kumiyi Iida	Aichi Institute of Technology, Japan

UNESCO - IOC - ITSU

13th Session of the IOC Assembly

The 13th Session of the Intergovernmental Oceanographic Commission Assembly was held in Paris, France from 12-28 March 1985. The Assembly also celebrated the 25th Anniversary of the Commission.

Prof. Warren Wooster of the University of Washington; Dr. S. Z. Qasim of the Dept. of Ocean Development of India; and Prof. A. Yankov of Bulgaria presented the three Bruun Memorial Lectures.

Important issues raised at the Assembly dealt with the development of appropriate intergovernmental structures for the co-ordination and implementation of the oceanographic component of the World Climate Reserach Programme, drifting-buoy programmes and an IOC Global Network of Sea-level Stations.

The Assembly is considering possible adjustments to the IOC Statutes and Rules of Procedure to adapt the Commission to the new situation in marine affairs. It is also studying the implementation of the Second Phase of the Long-term and Expanded Programme of Oceanic Research and Exploration (LEPOR-II), and the UNESCO/IOC Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries.

IODE Handbook Published

The revised edition of the above mentioned handbook is an up-dated version of the one published in 1982. This publication provides information on the composition of the International Oceanographic Data Exchange System. It is updated every two years.

List of National Contacts of ICG/ITSU

The following is a list of National Contacts of ITSU members on file in the ITIC office. Please inform ITIC if there are any changes.

CANADA

Mr. W. J. Rapatz
Regional Tidal Superintendent
Institute of Ocean Sciences
Dept. of Fisheries and Oceans
P. O. Box 6000
Sidney, B. C. V8L 4B2, Canada

CHILE	Captain Humberto Garcia Trivelli Director Instituto Hidrografico de la Armada Casilla 324 Valparaiso, Chile
CHINA	Mr. Luo Yuru Director National Bureau of Oceanography of the People's Republic of China Beijing, China
COLOMBIA	Capitan de Fragata Ernesto Cajiao Secretario General Comision Colombiana de Oceanografia Apartado aereo No. 28466 Bogota, D.E., Colombia
COOK ISLANDS	Commissioner H. R. Melrose Police National Headquarters P. O. Box 101 Rarotonga, Cook Islands
ECUADOR	Calm. Fernando Alfaro Echeverria Director Instituto Oceanografico de la Armada Casilla 5940 Guayaquil, Ecuador
FIJI	Mr. A. Rahiman Director, Mineral Development Mineral Resources Department Private Mail Bag Suva, Fiji
FRANCE	Dr. M. Jacques Recy Directeur de la Recherche Office de la Recherche Scientifique et Technique Outre-Mer B.P. A5 Noumea Cedex (Nouvelle Caledonie) France
GUATEMALA	Ing. Carlos Rodolfo Martinez Giron Chief of Seismology Section INSIVUMEH 7a. Ave. 14-57, Zona 13 Guatemala, Guatemala

INDONESIA	Dr. Aprilani Soegiarto Directeur Lembaga Oceanologi Nasional of the Indonesian Institute of Sciences Kompleks Bina Samudera P. O. Box 580 Dak Jakarta, Indonesia
JAPAN	Dr. Mamoru Katsumata Head, Earthquake and Tsunami Observation Division Japan Meteorological Agency 1-3-4, Ote-machi, Chiyoda-ku Tokyo, Japan 100
KOREA (REPUBLIC OF)	Mr. Myong Bok An Director of Weather Analysis Central Meteorological Office 1 Songweol-dong, Ching-ku Seoul, 110 Korea
MEXICO	Lic. Ma de los Angeles Lopez-Ortega Ministro Consejero Encargada de Negocios a.i. UNESCO Delegacion Permanente de Mexico 1, Rue Miollis 75732 Paris, France
NEW ZEALAND	Mr. Norman M. Ridgway Dept. of Scientific a Industrial Research New Zealand Oceanographic Institute P. O. Box 12-346 Wellington North, New Zealand
PERU	Contralmirante Jorge A. del Aguila Sanchez Direccion de Hidrografia y Navegacion de la Marina Casilla Postal No. 80 Gamarra No. 500 Chucuito, Callao, Peru
PHILIPPINES	Mr. Conrado M. Santos Chief Geophysicist Physical Science Division Bureau of Coast a Geodetic Survey 421 Barraca St. San Nicolas, Manila, Philippines
SINGAPORE	Mr. Paul Lo Su Siew Director Meteorological Service Singapore P. O. Box 8 Singapore Changi Airport Singapore 9181, Republic of Singapore

THAILAND	Commander Thanom Charoenlaph Hydrographic Department Royal Thai Navy Bangkok 6, Thailand
UNITED KINGDOM (HONG KONG)	Mr. Patrick P. Sham Royal Observatory, Hong Kong 134A Nathan Road Kowloon, Hong Kong
USA	Mr. Richard H. Hagemeyer Director National Weather Service, Pacific Region P. O. Box 50027 Honolulu, Hawaii 96850
USSR	Dr. B. P. Khimitch Chief, Arctic and Antarctic Department USSR State Committee for Hydrometeorology and Natural Environmental Control 12, Pavlik Morozov Per. Moscow 123376 USSR
WESTERN SAMOA	The Superintendent Apia Observatory Private Mail Bag Apia, Western Samoa
Director, ITIC	Dr. George Pararas-Carayannis Director International Tsunami Information Center P. O. Box 50027 Honolulu, Hawaii 96850 USA (Cable Address: ITIC HONOLULU)
Chairman, ICG/ITSU	Mr. Norman M. Ridgway Dept. of Scientific & Industrial Research New Zealand Oceanographic Institute P. O. Box 12-346 Wellington North, New Zealand

NATIONAL AND AREA REPORTS

New Pacific Tide Party Chief

Lieutenant Commander Craig P. Berg has taken over as Chief of Pacific Tide Party as of July 1984. LtCmnd Berg was commissioned in the NOAA Corps in July 1973. He has served at the Atlantic Hydrographic Party; Earth Sciences Laboratory of the National Earth Satellite Service; and Pacific Marine Center. On board NOAA ships RAINIER, SURVEYOR, and MILLER, LtCmnd Berg conducted fisheries and oceanographic research, and hydrographic surveying. Prior to the post at the Tide Party, he worked in program planning for the six vessels based out of Pacific Marine Center in Seattle. He holds a B.S. degree in Hydrology from the Utah State University and a M.S. degree in Water Resources Engineering from the University of Maryland.

Tsunami Station Inspection

The Pacific Tide Party personnel completed the annual inspection of the following station:

Crescent City, California	16 Sept 1984
Honolulu, Hawaii	29-31 Jan 1985
Nawiliwili, Hawaii	6-9 Feb
Kahului, Hawaii	9-12 Feb
Hilo, Hawaii	13-14 Feb
Sand Point, Alaska	26 Feb - 2 Mar

New Satellite Transmitter Platforms Installed

Satellite-telemetered tide gauges have brought in significant addition to the data available to the Pacific Tsunami Warning Center. Three of such transmitters have been installed in Avarua, Cook Islands and in Baltra Island and La Libertad, in Ecuador in the past few months. Another one will be placed in La Punta, Peru in the latter part of May by Mr. Robert Ichida of the Pacific Tsunami Warning Center and Dr. David Enfield of Oregon State University.

THRUST

The project, which has been funded for the last two years, has completed all of its pre-event work. This pre-event work included the development of a large historical tsunami data base which was used to develop the "Tsunami in the Pacific Basin : 1900 - 1983" map. All numerical model simulations have been completed. Results of this effort will be used to formulate the evacuation plan for the

Valparaiso, Chile area. And last in the pre-event time frame is the development of a Standard Operating Plan for Valparaiso which is nearing completion.

All real-time work is continuing at this time. Procedures for the utilization of the GOES system has been completed. Instrument design has been completed. Procurements for all instrumentation has been initiated with bench testing of instruments to begin this summer.

Further details of the THRUST project will be presented at the Tsunami 85 conference in B.C., Canada.

ANNOUNCEMENTS

Tsunami Workshop

A workshop on the technical aspects of Tsunami Analysis, Prediction and Communication has been scheduled at the Institute of Ocean Sciences, Sidney, B.C., Canada on 29-31 July 1985.
The workshop will cover:

Tsunami data collection.

Activities and responsibilities of existing Tsunami Warning Centers in Hawaii, Alaska, Japan and USSR.

The need for and structure of future Regional Tsunami Warning Centers.

A discussion of the "THRUST" program.

Operational procedures related to tsunami watch and warning.

Water wave reporting procedures and communication plans.

Tsunami preparedness.

Tsunami research.

Tsunami instrumentation, covering seismological and water level measuring instrumentation, deep ocean tsunami gauges and telemetry systems.

Coastal Zone 85

The Fourth Symposium on Coastal and Ocean Management will be held 30 July to 2 August 1985 in Baltimore, Maryland. It will be a multi-disciplinary conference for professionals, interested citizens, and

decision-makers to exchange information and views. It will provide a forum to discuss coastal zone management and ocean resources issues related to use, protection, and development, and initiatives of this Administration and Congress in these areas. The overall conference theme is "New Directions for Coastal and Ocean Management".

Coastal Zone 85 will offer an opportunity to discuss improved jurisdiction arrangements, conservation and design considerations, enforcement policies, investigation and planning methods, data collection, and reserach efforts. The emphasis of this year conference will concentrate on the need for greater public understanding and involvement in ocean and freshwater issues.

Besides the regular conference sessions, five short courses are also offered during the conference. For further details and information, please contact:

Delores Clark
Coastal Zone 85
U. S. National Ocean Service, NOAA
11400 Rockville Pike, Rm. 638
Rockville, MD 20852
Phone: (301) 443-8031

Map of Tsunamis in the Pacific Basin, 1900-1983 Available

A new multicolor map depicting tsunamis in the Pacific Basin from 1900 to 1983 is now available from the National Geophysical Data Center (NGDC). This wall-size map (43" by 60" approximate scale 1:17,000,000) shows the locations of 405 events from 1900 to 1983 (including earthquakes, volcanic eruptions, and landslides) that caused tsunamis.

The map is available folded ($12.00, $14.00 non-U.S.A.) and rolled in a sturdy mailing tube ($20.00, not available outside U.S.A.). All non-federal orders must be prepaid. Send inquiries to:

National Geophysical Data Center
NOAA, Code E/GCX2
325 Broadway
Boulder, CO 80303
USA
Phone: (303) 497-6607
Telex: 592811 NOAA MASC BDR

Earthquake History of the United States (Through 1980) updated

This is a reprint of publication 41-1, Earthquake History of the United States, which includes an updated supplement that covers the years 1971-1980. Edited by Jerry L. Coffman and Carl A. von Hake, NOAA, National Geophysical Data Center, and Carl W. Stover, USGS

National Earthquake Information Service. It covers earthquake events in the United States from historical times through 1980. The cost is $10 ($11.50 non-U.S.A). For ordering information write to:

National Geophysical Data Center
NOAA, Code E/GCX2
325 Broadway
Boulder, CO 80303
USA

Abstract Journal in Earthquake Engineering published

This volume 13 (issues 1 and 2) provides a comprehensive access to 1983 world literature in earthquake engineering and earthquake hazards mitigation. The publication provides more than 2300 abstracts selected from technical journals, proceedings, research reports, books, monographs, and other publications of academic, professional, and governmental organizations in 24 countries. Topics cover general topics and conference proceedings; engineering seismology; strong motion seismometry; dynamics of soils, rocks, and foundations; dynamics of structures; earthquake-resistant design and construction and hazard reduction; earthquake effects; and earthquakes as natural disasters. The cost of the abstract, volume 13, issues 1 and 2 is $70 (U.S.A). For ordering information contact:

Abstract Journal in Earthquake Engineering
Earthquake Engineering Research Center
University of California, Berkeley
1301 South 46th Street
Richmond, CA 94804
USA

PTC '86

The 8th Annual Forum of the Pacific Telecommunications Council will be held on 12-15 January 1986, Hawaiian Regent Hotel. The theme is "Evolution of the Digital Pacific." The conference will focus on the current and future developments of telecommunication technologies in the pacific hemisphere, the management of human resources, a variety of workshops on al, cellular radio, planning techniques and executive training. For more information and registration contact: PTC '86, 1110 University Ave., Suite 308, Honolulu, HI 96826.

Eighth Australian Geological Convention

The Geological Society of Australia will hold the above mentioned convention in Adelaide, Australia in February 1986. The Convention's objective is to present a broad spectrum of papers from industry, educational institutions and government departments. Lectures and

displays will reflect present and future activities associated with the exploration, evaluation and exploitation of non-metallic and metallic minerals, water, petroleum, coal and oil shale resources, particularly in Australasia.

Keynote addresses will be presented by several eminent authorities and pre- and post-convention excursions are also planned.

For information, write to:

Secretary 8AGC
P. O. Box 292
Eastwood. S.A. 5063
Australia

Pacon 86

The Pacific Congress on Marine Technology will be held on 24-28 March 1986 at the Princess Kaiulani Hotel in Honolulu, Hawaii. The conference will stress on the impact of marine technology on the quality of life of the Pacific Islanders. The presentations will combine theoretical insights and empirical research on problems of current and continuing issues. Topics will include the following:

Ocean Sciences & Technology (OST)

Undersea Vehicles ə Ocean Robotics
Remote Sensing ə Oceanographic Satellites
GPS - Positioning ə Navigation (Update)
Ocean Acoustics
Pacific Hydrography ə Bathymetry
Offshore Engineering
DUMAND
Buoy Technology ə Oceanographic Instrumentation
Tsunami Instrumentation
Hawaiian Ocean Experiment (HOE)
Seafloor Hydrovents
Ocean Optics
Manned Undersea Science
Pacific Ocean - Atmosphere Interactions

Marine Resources Management (MRM)

Technology for Marine Fisheries
Ocean Energy
Marine Mining
Artificial Reefs
Marine Economics ə Planning
Marine Project Financing
Marine Tranportation ə Ports
Marine Education

Marine Cities
Marine Recreation
Technology for Mariculture
Paicfic Outer Continental Shelves (EEZ)
Marine Biotechnology

The Conference Committee is inviting papers for presentation at the Congress. Accepted papers will be considered for publication in the Proceedings. Please send title, abstract and session as soon as possible, but postmarked no later than 30 August 1985, to: PACON 86, c/o Sea Grant College Program, University of Hawaii at Manoa, Honolulu, Hawaii 96822.

Registration fee for the Congress is $190 (U.S.A.) prior to 15 February 1986, and $220 thereafter. Student registration is $15 per day or $40 for full Congress.

For further information write to: PACON 86, c/o Sea Grant College Program, University of Hawaii, Honolulu, Hawaii 96822

International Symposium on Natural and Man-Made Hazards

The above mentioned symposium will be held from 3-9 August 1986 in Rimouski and Quebec City, Canada. The symposium is sponsored by the Tsunami Society and hosted by The University of Quebec at Rimouski, Canada. The objectives of the Symposium are to promote the advancement of the hazards sciences, to perceive and exploit those aspects that are similar for some of the various hazards, to review the newest developments in a few selected fields, and also to outline new directions for future research. Topics to be presented may include the following:

Air - tropical and extra-tropical cyclones, thunderstorms, squall lines, lightning, hail, rainfall, snow, acide rain, nuclear winter, carbon dioxide effects, climatic changes, clear air turbulence, air pollution, visibility, fog.

Water - tsunamis, storm, surges, wind waves, edge waves, swell, abnormal water levels, tides and tidal bores, hydraulic jumps, flash floods, water spouts, ice flows, icebergs, icing on marine structures, ice jams in rivers, ice ride-up on shore, man-made storage of water resources and their environmental effects, water pollution.

Land - earthquakes, land slides, snow avalanches, floods and droughts, soil erosion, deforestation and desertification.

Authors are invited to submit extended abstracts of 2-3 pages (up

to 40 lines per page) to the Coordinator of the Symposium before October 31, 1985. Camera-ready abstracts should be submitted.

Post-symposium excursions and visits are also being planned. Interested individuals should contact or write to:

Dr. Mohammed El-Sabh
Departement d'Oceanographie
Universite du Quebec a Rimouski
310 Avenue des Ursulines
Rimouski (Quebec)
G5L 3A1
Canada

ABSTRACTS

Use of Long-Period Seismic Waves for Rapid Evaluation of Tsunami Potential of Large Earthquakes

Hiroo Kanamori and Jeffrey W. Given
Seismological Laboratory, California Institute of Technology
Pasadena, California

Two seismological methods for rapid evaluation of tsunami potential of an earthquake are discussed. In the first method, long-period (200 to 300 sec) surface waves are used to determine the seismic moment and the fault geometry. This method allows determination of the source parameters in about 10 minutes after the surface-wave data have been retrieved, and is appropriate for far-field tsunami warning purposes.

In the second method, long-period (100 to 300 sec) near-field displacements are used to estimate the seismic moment. Our numerical experiment for a source-station geometry appropriate for Japan demonstrates that a very rapid and robust method can be developed for near-field tsunami warning purposes, if an appropriate (long-period, low gain) recording system is available.

Magnification Factor for Tsunami Risk Evaluation

Takeo Kinoshita, Tatsuo Konishi and Yoshimobu Tsuji
National Research Center for Disaster Prevention, Japan

The coastal areas in Japan, which have been rapidly developed for ports and harbours, industrial and recreation areas in recent years, are vulnerable to a tsunami (a tidal wave caused by an earthquake). The tsunami risk evaluation is needed very much from the view point of disaster prevention and preparedness at the coastal area. The estimates of the magnitude of the forthcoming earthquake and the

frequency of its occurrence have been well discussed based on modern seismology. Therefore the magnitude of the forthcoming tsunami, the frequency of its occurrence and the generation place will be able to be assumed. The propagation of the tsunami in an open ocean can be easily made clear by the numerical simulation or the hydraulic simulation. But a difficulty is found at the analysis of the propagation through a continental shelf. The accuracy of the simulation is not sufficient on the continental shelf because of the complicated technique in numerical modeling or hydraulic testing at the discontinuity of the bottom topography at the continental shelf.

The authors propose the magnification factor which is defined as the ratio of the observed tsunami height to the calculated tsunami height. The observed tsunami height here means the height of the maximum tsunami wave above the mean sea level observed at the Japan Sea coast by the authors immediately after the Nihonkai-Chubu Earthquake, 1983. The calculated tsunami height means the height of the maximum tsunami wave obtained at the shelf edge, which is defined as the isobath of 200 m, by the numerical calculation with the 5 km meshes all over the Japan Sea carried out by the authors. The basic equations of the calculation are shown in Eqs. (2) and (3). The correspondence of the calculation point and the observed point is simply determined by the line normal toe very isobath between the coast and the shelf edge. The resultant magnification factor, R, has the trend increasing with the distance between the sea coast and the corresponding shelf edge as shown in Fig. 2 where the abscissa is the distance. The trend is somewhat bent on the figure, but it may be simply expressed by Eq. (4) for operational purpose,

$$R = 2 \qquad L < 4 \text{ km} \qquad (4)$$
$$R = 0.151L + 1.451 \qquad 4 \leq L \leq 35 \text{ km}$$

where L is the distance in km. The broken curves in the figure mean the run-up height relation proposed by Shuto (1972). The trend of the magnification factor is well agreed to the run-up height relation within some assumptions. It is concluded that the magnification factor is useful to increase the accuracy of the estimation of the tsunami height at the coast line for risk evalaution of tsunami.

$$\frac{\partial u}{\partial t} = -g\frac{\partial \zeta}{\partial x} \qquad \frac{\partial v}{\partial t} = -g\frac{\partial \zeta}{\partial y} \qquad (2)$$

$$\frac{\partial \zeta}{\partial t} = -\left(\frac{\partial uh}{\partial x} + \frac{\partial vh}{\partial y}\right) \qquad (3)$$

[In Japanese]

(Report of the National Research Center for Disaster Prevention, No. 33, November 1984, pp. 15-22)

On Tsunamis in Tanabe and Shirahama

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This is a survey report on tsunamis in Tanabe and Shirahama. At first, a numerical model is studied to know a specific property of a tsunami propagation with some consideration of numerical simulation to an observed big tsunami. In order to know any possibility of the forthcoming big tsunami, it is essential to gather data from old documents and tsunami catalogues. An application of stochastic process to the time history of the big tsunmai leads to obtaining a convenient measure for tsunami warning and counter measures, that is, in form of an exceedence probability for a given tsunami magnitude in a given time interval after applying a Poisson process to the local tsunami history in Tanabe and Shirahama.

[In Japanese]

(Disaster Prevention Research Institute Report, No. 27, B-2, 20 pp.)

PACIFIC TSUNAMI WARNING CENTER

Geostationary (GOES) Satellite

The Pacific Tsunami Warning Center (PTWC) is utilizing the Geostationary (GOES) Satellite for receiving near real time water level data in the Pacific. Satellite transmission to PTWC constitutes a major operational improvement to the Tsunami Warning System. Data Collection Platform (DCP) operates on independent power sources, transmitted via GOES, which provides continuous sea level measurements to PTWC to detect and evaluate a tsunami.

PTWC, in cooperation with Dr. Klaus Wyrtki of the University of Hawaii and Dr. Dave Enfield of Oregon State Unviersity, uses HANDAR DCPs. These DCPs have programmable, independent multi-channel input. Five channels are now being programmed--2 sea level, 2 temperature, and 1 battery voltage.

PTWC benefits from the sea level channel that has a 5-second sample

rate, averaged over 4-minute intervals and transmitted every 3 or 4 hours. PTWC receives the data minutes after transmission. An event-detector capability transmitting on the GOES emergency channel is utilized when thresholds in sea level are exceeded. This gives PTWC almost instantaneous warning that a tsunami has been generated.

The GOES satellite is limited in its coverage of the Pacific Ocean (see figure). In the future other Geostationary satellites will be utilized to cover and protect the Pacific Ocean region.

Seismic Summary (December 1, 1984 to Press Time)

EVENT NO	EVENT	LOCATION	ACTION TAKEN
1984-17 (PTWC)	Dec 11 2322 (UT) 6.6	Northern Chile 22.2S 68.2W	No Earthquake Information Bulletin issued. Earthquake data and information sent to Chile via TELEX
1984-18 (PTWC)	Dec 28 1038 (UT) 6.7	Kamchatka, USSR 56.3N 163.4E	Earthquake Information Bulletin issued.
1985-1 (PTWC)	Jan 21 0055 (UT) 6.9	Halmahera, Indonesia 00.5N 128.6E	Earthquake Information Bulletin issued.
1985-2 (PTWC)	Mar 2 1548 (UT) 6.5	Sulawesi, Indonesia 00.7S 119.6E	No Earthquake Information Bulletin issued.
1985-3 (PTWC)	Mar 3 2247 (UT) 7.4	Valparaiso, Chile 34.2S 70.4W	Earthquake Information Bulletin issued; minor tsunami generated.
1985-4 (PTWC)	Mar 19 0401 (UT) 6.7	Chile 31.4S 67.5W	Earthquake Information Bulletin issued.
1985-5 (PTWC)	Apr 7 0020 (UT) 6.6	East Pacific Rise 55.2S 118.7W	Earthquake Information Bulletin issued.
1985-6 (PTWC)	Apr 9 0157 (UT) 7.4	Valparaiso, Chile 33.6S 071.4W	Earthquake Information Bulletin issued

1985-7		Apr 13 0300 (UT)	Molucca Sea, Indonesia 02.3N	Earthquake Information Bulletin issued
	(PTWC)	6.9	126.8E	
1985-8		May 10 1536 (UT)	New Britain 5.1S	Earthquake Information
	(PTWC)	7.0	151.0E	Bulletin issued
1985-9		Jun 3 1207 (UT)	Western Samoa 14.6S	Earthquake Information
	(PTWC)	6.6	173.3W	Bulletin issued.